IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Appl No.	:	10/080,302
Applicant	:	Alois Sferrazza
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Examiner	:	Arun S. Phasge
Docket No.	:	27325.00
Customer No.	:	22465
Assignee	:	EET Corporation
Title	:	Multi-path Split Cell Spacer and Electrodialysis Stack Design
Express Mail	:	EV 431723614 US

DECLARATION OF REPRESENTATIVE OF EET CORPORATION UNDER 37 C.F.R. §1.132

DECLARANT: ALOIS F. SFERRAZZA

1. I, Alois F. Sferrazza, declare as follows, under penalty of perjury.

2. I hold a Bachelor of Science degree in Mechanical Engineering and Materials Science from the University of California, Berkeley, awarded in June 1978, an MBA degree in Finance from the University of Colorado, Boulder, awarded in June 1982, and have completed advanced studies in engineering from the Colorado School of Mines. I have been involved with the design, development, testing and application of electrodialysis technologies since 1998.

3. My position at EET Corporation, Harriman, Tennessee, is President. I have previously served as Vice President of EET Corporation, and have served jointly in management and in research and development at EET Corporation for fourteen (14) years. Prior to my employment with EET Corporation, I served in management and technical positions with Rockwell International Corporation and EG&G, Rocky Flats, Inc., at facilities in Colorado, where I managed, directed and/or conducted research and development duties as part of my job functions for eleven (11) years.

4. I have reviewed the pending patent application referenced above, Serial Number 10/080,302, filed on February 21, 2002, for which I am identified as an inventor.

5. I have reviewed the Final Office Action mailed August 25, 2004, the Non-final Office Action mailed March 10, 2004, and the referenced patents including U.S. Patent 6,117,297, issued to Goldstein, and U.S. Patent 6,274,020, issued to Schmidt et al.

6. My review of U.S. Patent 6,117,297, issued to Goldstein, provides that Goldstein only teaches a monolithic frame-membrane that is composed of solid frame perimeter materials which are bonded to form a monolithic, integral frame by heating in an oven until the frame surfaces contacting each other are fused together. Goldstein teaches that the frame-members are bonded into the integral, monolithic frame which is welded thermally, or ultrasonically, or by laser means. The frame-membrane of Goldstein is not readily disassembled when one or more intermediate layers fail, and, if the frame is disassembled, the fused frame surfaces will be torn upon separation. The frame-membrane taught by Goldstein can not be disassembled for replacement or reorientation of one or more interior layers including the anode, cathode, interior membranes, spacers, and gaskets if one or more of the layers fail.

7. My review of Goldstein provides that each aperture of the frame-membrane of Goldstein is formed with a width or depth (see Fig. 4), that allows for ion exchange polymer/resin beads in a pillow to be contained within the frame, therefore Goldstein's frame-membrane requires a minimum width or depth and is not readily stackable with adjacent flat surfaced spacers or membranes. Goldstein does not provide any suggestion to utilize connector bolts or other removable connectors, and therefore does not provide any suggestion as to placement of connectors through the width or depth of a plurality of stacked frame-membranes. It is respectfully emphasized that Goldstein requires containment within the frame of at least one pillow containing a plurality of ion exchange polymer/resin beads in order to accomplish ion exchange, which is not utilized or needed in the invention of the pending patent application.

8. My review of Goldstein further provides that the frame-membrane of Goldstein requires containment of ion exchanging polymer/resin beads to achieve ion exchange, and it is my opinion that Goldstein is not a valid prior art patent for comparison with the invention of the pending patent application. The invention of the pending patent application includes multiple layers of planar membranes alternated in stacked planar layers with spacers forming planar gaskets having apertures separated by at least one partition. The invention does not need a width or depth spacing of each planar gasket

for inclusion of polymer/resin beads. In fact, the rigid bonding of the rigid frame-member of Goldstein and the need for ion exchange polymer/resin beads within the frame-member, significantly teaches away from the invention of the pending patent application, which includes a plurality of layers which are not permanently bonded together, are designed to be disassembled and reassembled with the same or different layers of membranes and gaskets as needed, and is designed to provide highly efficient removal of ions and other contaminants from liquids flowing through each gasket aperture of each level of the membrane stack without a need for polymer/resin beads.

9. My review of U.S. Patent 6,274,020, issued to Schmidt et al., provides that Schmidt et al. only teaches a membrane cell stack retained in a support frame having connector rods extended through outer perimeter edges of a membrane cell stack (see Figs. 1 and 7). Schmidt et al. does not teach, suggest or disclose one or more connectors extended through holes disposed in positions other than the outer edges of the membrane stack. Further, Schmidt et al. teaches gaskets (see Fig. 4) having open center portions lacking a partition interdisposed within each gasket interior, in order to provide an uninterrupted flow path across each gasket for directed flow between opposed corners of each respective gasket (also see Fig. 5). The open center portion of each gasket of Schmidt et al. teaches away from the configuration of the invention of the pending application, including spacers having gaskets defining at least a first and second aperture separated by at least one partition. Schmidt et al. does not teach a gasket stack which allows for concurrent flow in series or in parallel, as provided by the invention of the pending application including each gasket aperture defining an independent cell between interleaved membranes through which multi-path flow communication occurs in either series or parallel for improved efficiency of removal of contaminants and ions from fluids. In addition, Schmidt et al. does not teach the need for non-conductive connectors, because Schmidt et al. teaches the positioning of connector bolts through the outer perimeter edges of a membrane cell stack, therefore negating contact between the perimeter connector bolts with the anode and cathode plates, or the respective gaskets, spacers and membranes of the membrane cell stack.

10. Electrodialysis efficiency, power consumption and costs are strongly affected by the stack design. The limiting current density, feed-flow pressure losses, and internal and external leakages impact the investment costs particularly. The common practice for fastening stacks with connector bolts and attaching members is that connectors

are positioned around only the perimeter of a stack, resulting in applying external pressure onto the assembly perimeter, with uneven pressure applied to the gasket and membrane materials, depending on the geometry of the end plate, compression plate(s), physical properties of the materials of construction, and on the accuracy of the torque applied to each connector bolt. When hydraulic pressure is used to facilitate sealing, these systems are expensive, heavy, subject to pressure fluctuations due to temperature variances, hydraulic fluid leakage, and the uniformity of the pressure distribution remains dependent on geometry of the assembly perimeter, tolerances for the compression plate(s), and materials of construction.

11. My knowledge of the art allows me to state that the use of perimeter positioned connectors during assembly and operation of electrodialysis membrane stacks for stacked retention and maintenance of the continuity between membranes and interleaved spacers and/or gaskets is common practice in the art. Prior practice for fastening membrane stacks includes connector bolts inserted in a pattern around a perimeter of a membrane stack, which negates a need for the connectors to be electrically insulated, due to the perimeter positioned connector bolts not contacting electrodes or ion exchange membrane materials (see Schmidt et al.).

12. Up until February 2002, and since February 2002 until the present date, I nor any of my EET colleagues, have ever seen, read about, or heard of an electrodialysis stack connected with fastening connectors other than around the perimeter of the membrane stack assembly.

13. Up until February 2002, and since February 2002 until the present date, I, nor any of my EET colleagues, have ever seen, read about, or heard of an electrodialysis stack connected with fastening connectors that were electrically insulated. There was no need or suggestion for the prior art technology to utilize fastening connectors that were electrically insulated due to the positioning of connector bolts in a pattern around and about the perimeter of a stack (see Schmidt et al.), which negated connector bolts from contacting electrically charged probes or interleaved layers of membranes, gaskets, and/or spacers of the membrane stack.

14. Up until February 2002, and since February 2002 until the present date, I, nor any of my EET colleagues, have witnessed, read in the published literature, or heard of an electrodialysis stack connected with fastening bolts that pass through the ion

exchange membrane sheets, except for the invention which is the subject of the pending application.

15. Up until February 2002, and since February 2002 until the present date, I, nor any of my EET colleagues, have witnessed, read in the published literature, or heard of an electrodialysis stack connected with fastening bolts that pass through portions of partitions proximal of middle partition segments within the respectively stacked gasket sheets, except for the invention which is the subject of the pending application. .

16. Up until February 2002, and since February 2002 until the present date, I, nor any of my EET colleagues, have witnessed, read in the published literature, or heard of any type of membrane-based process, such as reverse osmosis, nanofiltration, ultrafiltration, microfiltration, electrodialysis reversal, continuous deionization, filled cell electrodialysis, etc., connected with non-perimeter fastening connectors which pass through the gasket or membrane sheets, and have non-conductive coatings thereon or are composed of non-conductive materials.

17. Use of non-perimeter connectors such as removable bolts to fasten electrodialysis stacks in the manner described in the subject patent application is significantly unique in the fields of electrodialysis, ion exchange membrane-based processes, electro-deionization methods, and/or pressure-based membrane processes. Neither of the referenced U.S. Patents, Goldstein or Schmidt et al., provide any suggestion or teaching to modify the prior art practice of perimeter bonding, or perimeter connecting, of a plurality of membranes to form a functional electrodialysis membrane stack.

18. Use of non-perimeter connectors to fasten electrodialysis stacks with a high accuracy torque wrench, in the manner described in the subject patent application, offers the advantage of accurate and uniform pressure application across the width and length of the electrodialysis stacks, therefore providing optimal sealing ability between respective membranes, spacers and gaskets. An optimal seal minimizes pressure losses from the stack and minimizes fluid losses from the Dilute (D) liquid stream to, or from, the Concentrate (C) liquid stream, resulting in maximizing recovery of deionized liquid and maximizing ion removal effectiveness.

19. The use of removable connectors through central portions of the membrane stack as described in the subject patent application also offers a lower cost, higher

performance alternative to applying the gasket sealing force than does a hydraulic or mechanical ram, a common electrodialysis technique for applying pressure to the seals.

20. The multi-cell design of the subject patent application offers processing advantages and capital cost economies; the capital cost of a stack assembly is minimized through the use of bolts, that may or may not be insulated, that are fastened between the cells, and processing difficulties (leaks, capacity limitations) are mitigated through the use of non-perimeter bolts and nuts.

21. In summary, it is my professional opinion that the separate, or combined, teachings of the prior art, including but not limited to U.S. Patent 6,117,297 (Goldstein), and U.S. Patent 6,274,020 (Schmidt et al.), do not disclose, teach or make obvious the invention of the pending patent application. Specifically, a concept is not disclosed or taught in the prior art for providing advantageous positioning of removable connectors inserted through mid-width gasket partitions providing split separation between two or more apertures in one or more gaskets utilized as spacers and interleaved with membranes in an electrodialysis system as claimed in the pending U.S. Patent Application, Serial No. Serial Number 10/080,302.

Respectfully submitted,

Alois F. Sferrazza, Declarant
President
EET Corporation
3106 Roane State Hwy.
Harriman, TN 37748

Sworn to and subscribed before me, this 8th day of October, 2004

Notary Public: _____

My Commission Expires: March 4, 2006 Seal affixed.

Elizabeth DeWitt
Notary At Large
Knox County, TN
My Commission Expires March 04, 2006.